DEFENSE INFORMATION SYSTEMS AGENCY
P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY REFER TO: Joint Interoperability Test Command (JTE) 29 Jul 08

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Nortel Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006
(c) through (f) see enclosure 1

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The Nortel ASVALAN and VALAN with Specified Software Releases is hereinafter referred to as the system under test (SUT). The SUT meets all of its critical interoperability requirements and is certified as interoperable for joint use within the Defense Switched Network (DSN). The SUT is certified for joint use within the DSN with the Digital Switching Systems on the DSN Approved Products List (APL) which are certified for use with an ASVALAN or VALAN. The SUT components which are bolded and underlined in the tables throughout this certification letter are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined, but also listed throughout the tables in this letter, are certified for joint use in the DSN as well. The JITC analysis determined these components contain the same hardware and software and are functionally identical to the tested components for interoperability certification purposes. The SUT is certified to support DSN Assured Services over Internet Protocol as an ASVALAN. If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN. However, since VALANs do not support the Assured Services Requirements detailed in reference (c), Command and Control (C2) users and Special C2 users are not authorized to be served by a VALAN. Since VALANs do not support Assured Services, they can only serve Department of Defense (DoD), non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. VALAN connectivity to the DSN is not authorized until a waiver is granted by the Joint Staff for each site. The SUT is certified for joint use as a VALAN for non-C2 traffic. The VALAN requirements differing from those of an ASVALAN include:

- C2 traffic shall not traverse a VALAN.

- Reliability is a conditional requirement for a VALAN.

- Network Management features are conditional requirements for a VALAN.

Testing did not include video services or data applications; however, simulated data traffic was generated during testing to determine its effect on voice traffic. No other configurations, features, or functions, except those cited within this report, are certified by the JITC, or authorized by the Program Management Office for use within the DSN. This certification expires upon changes that could affect interoperability, but no later than three years from the date of this memorandum.

3. This finding is based on interoperability testing conducted by JITC and a review of the vendor's Letters of Compliance (LoC). Testing was conducted at JITC's Global Information Grid Network Test Facility at Fort Huachuca, Arizona, from 19 November 2007 through 04 February 2008. Review of the vendor's LoC was completed on 04 February 2008**.** Review of the system and the vendor's mitigation for an open discrepancy for a stacked configuration was conducted from 18 February through 7 March 2008. Further regression testing of the ERS5530-24TFD in the distribution layer was performed from 21 April to 2 May 2008. Enclosure 2 documents the test results and describes the tested network.

4. The overall interoperability status of the SUT is indicated in table 1. The ASVALAN and VALAN system requirements are listed in table 2. In addition to system level requirements, components that comprise the SUT must meet specific criteria to be certified for use as core, distribution, or access components. The interoperability status of the SUT components is listed in table 3. The ASVALAN and VALAN requirements used to certify the components are listed in table 4. This interoperability test status is based on the SUT's ability to meet:

a. Assured Services as defined in references (c).

b. Local Area Network system requirements specified in references (d) and (e) verified through JITC testing and/or vendor submission of LoC.

c. Internet Protocol version 6 requirements specified in reference (d), paragraph 1.7, table 1-4, verified through vendor submission of LoC signed by the Vice President of the company.

d. The overall system interoperability performance derived from test procedures listed in reference (f).

Table 1. SUT Interoperability Status

System Interoperability Status			
Components (See note.)	**Release**	**Status**	**Remarks**
ERS8610, ERS8606	4.1.4	Certified	All ASVALAN and VALAN system requirements were met when the SUT was configured in accordance with architecture provided in enclosure 2. Additional details about component level certification are provided in table 3. Security testing is accomplished through DISA-led Information Assurance Test teams and published in a separate report.
ERS5530-24TFD, 5520-48T-PWR, 5520-24T, 5510-48T, 5510-24T	Firmware 5.0.0.4 Software 5.0.6.207		
ERS4548GT-PWR, ERS4548GT, **ERS4550T-PWR,** ERS4550T, **ERS4526FX**	Firmware 5.0.1.0 Software 5.0.1.209		

LEGEND:

ASVALAN	- Assured Services Voice Application Local Area Network	JITC	- Joint Interoperability Test Command
DISA	- Defense Information Systems Agency	PWR	- Power over Ethernet
ERS	- Ethernet Routing Switch	SUT	- System Under Test
FD	- Fiber distribution	T	- Base T
FX	- 100BaseFX fiber	VALAN	- Voice Application Local Area Network
G	- Gigabit		

NOTE: Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

Table 2. ASVALAN and VALAN System Requirements

System Requirements				
Requirement	**Criteria**		**Reference**	**Required**
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, Section A.3.3.1.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, Section A.3.3.1.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		GSCR, Appendix 3, Section A.3.3.1.3	Yes
Reliability	ASVALAN	- ASVALANs shall have a reliability of .99999 - No single point of failure for outage of more than 64 telephony subscribers - Network Path restores within 5 seconds	GSCR, Appendix 3, Section A.3.3.4.1, UCR, Appendix 3 A3.3.9.3	Yes
	VALAN	- This requirement is conditional for a VALAN.	GSCR, Appendix 3, Section A.3.3.4.1	No
IPv6[1]	All IP devices shall be IPv6 capable.		GSCR, Paragraph 1.7, and GSCR Appendix 3, Section A3.2.8	Yes
Security[2]	DIACAP (replacement for DITSCAP)/IA		GSCR, Appendix 3, Section A.3.3.4.3	Yes

LEGEND:

ASVALAN	- Assured Services Voice Application LAN	IP	- Internet Protocol
DIACAP	- DoD IA Certification and Accreditation Process	IPv4	- Internet Protocol version 4
DISA	- Defense Information Systems Agency	IPv6	- Internet Protocol version 6
DISR	- DoD IT Standards Registry	IT	- Information Technology
DITSCAP	- DoD IT Security Certification and Accreditation Process	LAN	- Local Area Network
DoD	- Department of Defense	ms	- milliseconds
GSCR	- Generic Switching Center Requirements	UCR	- Unified Capabilities Requirements
IA	- Information Assurance	VALAN	- Voice Application LAN

NOTES:

1 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria by**:**

a. Conformant with IPv6 standards profile contained in the DoD IT Standards Registry (DISR).
b. Maintaining interoperability in heterogeneous environments and with IPv4.
c. Commitment to upgrade as the IPv6 standard evolves.
d. Availability of contractor/vendor IPv6 technical support.

2 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 3. SUT Component Interoperability Status

Component Interoperability Status					
Component (See note 1.)	**Release**	**Sub-component (See note 1.)**	**Status**	**Layer (s)**	**Remarks**
ERS8610, ERS8606	4.1.4	**ERS8692, ERS8692SF**[2]	Certified	Core, Distribution, Access	All CRs and FRs were met.
		ERS8683XLR, ERS8683XZR	Certified		
		ER8648GTR, ERS8630GB	Certified		
		ERS8005DC, ERS8005AC, **ERS8004AC**	Certified		
ERS5530-24TFD	Firmware 5.0.0.4 Software 5.0.6.207	Not Applicable	Certified	Distribution[3]	All CRs and FRs were met.
ERS5530-24TFD, 5520-48T, 5520-24T, 5510-48T, 5510-24T	Firmware 5.0.0.4 Software 5.0.6.207	Not Applicable	Certified	Access[4]	All CRs and FRs were met.
ERS4548GT-PWR, ERS4548GT, **ERS4550T-PWR,** ERS4550T, **ERS4526FX**	Firmware 5.0.1.0 Software 5.0.1.209	Not Applicable	Certified	Access[4]	All CRs and FRs were met.

LEGEND:

AC	- Alternating Current	GTR	- Gigabit base T
CRs	- Capability Requirements	IPv6	- Internet Protocol version 6
DC	- Direct Current	JITC	- Joint Interoperability Test Command
DSN	- Defense Switched Network	PMO	- Program Management Office
ERS	- Ethernet Routing Switch	PWR	- Power over Ethernet
FD	- Fiber distribution	SUT	- System Under Test
FRs	- Feature Requirements	T	- Base T
FX	- 100BaseFX fiber	XLR	- 10 G XFP Long Range
G	- Gigabit	vAC	- Volts Alternating Current
GB	- GBIC interface	vDC	- Volts Direct Current
GBIC	- Gigabit Interface Connector		

NOTES:

1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

2 This card includes a daughter board which provides enhanced IPv6 performance. However, IPv6 capability was not tested, it was satisfied by the vendor's Letter of Compliance.

3 The ERS5530-24TFD switch is authorized for use in the distribution layer provided both the 120 vAC and the 48 vDC power inputs are utilized. The ten Gigabit fiber interfaces due to excessive frame loss, are not certified by JITC nor authorized for use by the DSN PMO.

4 The ERS4500 series and ERS5500 series switches listed in table 3 are authorized for use in the access layer as standalone units. These same series switches listed in table 3 are also authorized for use in the access layer in a stacked configuration when equipped with dual power supplies (120 vAC and 48 vDC) for all the switches which utilize an uplink.

Table 4. ASVALAN and VALAN Component Requirements

Core/Distribution/Access Component Requirements			
Requirement	**Criteria**	**Reference**	**Required**
CoS Models	LAN components shall support IEEE 802.1p to DSCP mapping and at least one of the following: - IEEE 802.1p/Q priority tagging/VLAN tagging - DSCP - ToS	GSCR, Appendix 3, Section A.3.3.2.1	Yes
Traffic Prioritization	Traffic within LAN components shall be prioritized so that voice signaling receives highest priority, voice media second highest priority, and data lowest priority.	GSCR, Appendix 3, Section A.3.3.2.2	Yes
QoS	LAN components shall support one of the following: - Priority Queuing - Custom Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing	GSCR, Appendix 3, Section A.3.3.3.1	Yes
Policing	LAN components shall support one of the following: - DSCP PHB - Generic Traffic Shaping - Class-Based Shaping	GSCR, Appendix 3, Section A.3.3.3.2	Yes

Table 4. ASVALAN and VALAN Component Requirements (continued)

Core/Distribution/Access Component Requirements				
Requirement	**Criteria**		**Reference**	**Required**
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Protocol based VLANs		GSCR, Appendix 3, Section A.3.3.3.3	Yes
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol		GSCR, Appendix 3, paragraph A.3.3.4	Yes
Reliability	ASVALAN	LAN components shall support: - ASVALAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 users) - N+1 sparing for access (more than 64 users) - Redundancy protocol[1] - 5 second path restoral	GSCR, Appendix 3, Section A.3.3.4.1 UCR, Appendix 3 A3.3.9.3	Yes
	VALAN	This requirement is conditional for a VALAN.	GSCR, Appendix 3, Section A.3.3.4.1	No
Network Management	ASVALAN	LAN components shall support: - In-band or out-of-band management - SNMP - Measurements	GSCR, Appendix 3, Section A.3.3.4.2	Yes
	VALAN	This requirement is conditional for a VALAN.	GSCR, Appendix 3, Section A.3.3.4.2	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs.[2]		GSCR, Appendix 3, Section A.3.3.4.3	Yes
IPv6	All IP devices shall be IPv6 capable.[3]		GSCR, Paragraph 1.7, and GSCR Appendix 3, Section A3.2.8	Yes
TE	ASVALAN	- ASVALAN components shall be engineered for a maximum of 25% voice traffic per link.[4] - For more than 64 users, link pairs (redundant links) must be used.	GSCR, Appendix 3, Section A.3.3.4.4	Yes
	VALAN	VALAN components shall be engineered for a maximum of 25% voice traffic per link.[4]	GSCR, Appendix 3, Section A.3.3.4.4	Yes

LEGEND:

802.1d	- Standard for Local and Metropolitan Area Networks: MAC Bridges
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization
802.1Q	- Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks
802.1s	- Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees
802.1v	- Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition)
802.1w	- Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration
802.1x	- Standard for Local and Metropolitan Area Networks Port-Based Network Access Control
802.3ad	- Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications–Aggregation of Multiple Link Segments
ASVALAN	- Assured Services Voice Application LAN
CoS	- Class of Service
DISA	- Defense Information Systems Agency
DISR	- DoD IT Standards Registry
DSCP	- Differentiated Services Code Point
GSCR	- Generic Switching Center Requirements
IEEE	- Institute of Electrical and Electronics Engineers
IP	- Internet Protocol
IPv4	- Internet Protocol version 4
IPv6	- Internet Protocol version 6
LAN	- Local Area Network
MAC	- Media Access Control
Mbps	- Megabits per second
N	- total VoIP users / 64
OSPFV.3	- Open Shortest-Path First Version 3
PHB	- Per Hop Behaviors
QoS	- Quality of Service
SNMP	- Simple Network Management Protocol
STIG	- Security Technical Implementation Guide
TE	- Traffic Engineering
ToS	- Type of Service
UCR	- Unified Capabilities Requirements
VALAN	- Voice Application LAN
VLANs	- Virtual LANs
VoIP	- Voice over Internet Protocol
VRRP	- Virtual Router Redundancy Protocol

Table 4. ASVALAN and VALAN Component Requirements (continued)

NOTES:
1 For core and distribution components, OSPF V.3 redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol.
2 Verified using the Information Assurance Test Plan. Results of the security testing are published in a separate test report generated by the DISA Information Assurance test personnel.
3 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria**:**
a. Conformant with IPv6 standards profile contained in the Department of Defense Information Technology Standards Registry (DISR).
b. Maintaining interoperability in heterogeneous environments and with IPv4.
c. Commitment to upgrade as the IPv6 standard evolves.
d. Availability of contractor/vendor IPv6 technical support.
4 Instruments connected to an access device must provide a minimum of a 10 Mbps full duplex link. For core and distribution connections, the minimum link capacity is 100 Mbps full duplex.

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at https://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

6. The JITC point of contact is Captain Oskar Widecki, DSN 879-5269, commercial (520) 538-5269, FAX DSN 879-4347, or e-mail to oskar.widecki@disa.mil. The JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 0714401.

FOR THE COMMANDER:

2 Enclosures a/s

for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Nortel Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases

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U.S. Coast Guard, CG-64, 2100 2nd St. SW, Washington, DC 20593
Defense Intelligence Agency, 2000 MacDill Blvd., Bldg 6000, Bolling AFB, Washington, DC 20340-3342
National Security Agency, ATTN: DT, Suite 6496, 9800 Savage Road, Fort Meade, MD 20755-6496
Director, Defense Information Systems Agency, ATTN: GS235, Room 5W24-8A, P.O. Box 4502, Falls Church, VA 22204-4502
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U.S. Joint Forces Command, J68, Net-Centric Integration, Communications, and Capabilities Division, 1562 Mitscher Ave., Norfolk, VA 23551-2488
Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. McLaughlin), Room 5W23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

(c) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01C, "Policy for Department of Defense Voice Services with Real Time Services (RTS)," 9 November 2007
(d) Defense Information Systems Agency (DISA), "Defense Switched Network (DSN) Generic Switching Center Requirements (GSCR), Appendix 3, Errata Change 2," 14 December 2006, Revised 27 March 2007
(e) Defense Information Systems Agency, "Department of Defense Voice Networks Unified Capabilities Requirements, 21 December 2007
(f) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Nortel Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases; hereinafter referred to as the system under test (SUT).

2. PROPONENT. Electronic Systems Center (ESC) CIO.

3. PROGRAM MANAGER. Ann Markman, ESC CIO, 11 Elgin St., Bldg. 1618, Hanscom Air Force Base, Massachusettes, 01731, e-mail: ann.markman@hanscom.af.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT is used to transport voice signaling and media as part of an overall Voice over Internet Protocol (VoIP) system. All of the SUT switches provide availability, security, and Quality of Service (QoS) to meet the operational requirements of the network and Assured Services for the warfighter. The SUT components which are bolded and underlined in the tables throughout this certification letter, are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined but also listed throughout the tables in this letter were determined by JITC analysis to contain the same hardware and software as, and to be functionally identical to, the tested components for interoperability certification purposes. The SUT is certified for joint use within the Defense Switched Network (DSN) with the Digital Switching Systems on the DSN Approved Products List (APL), which are certified for use with an ASVALAN or VALAN. The SUT is certified to support DSN Assured Services over Internet Protocol (IP) as an ASVALAN.

The SUT is composed of the following components:

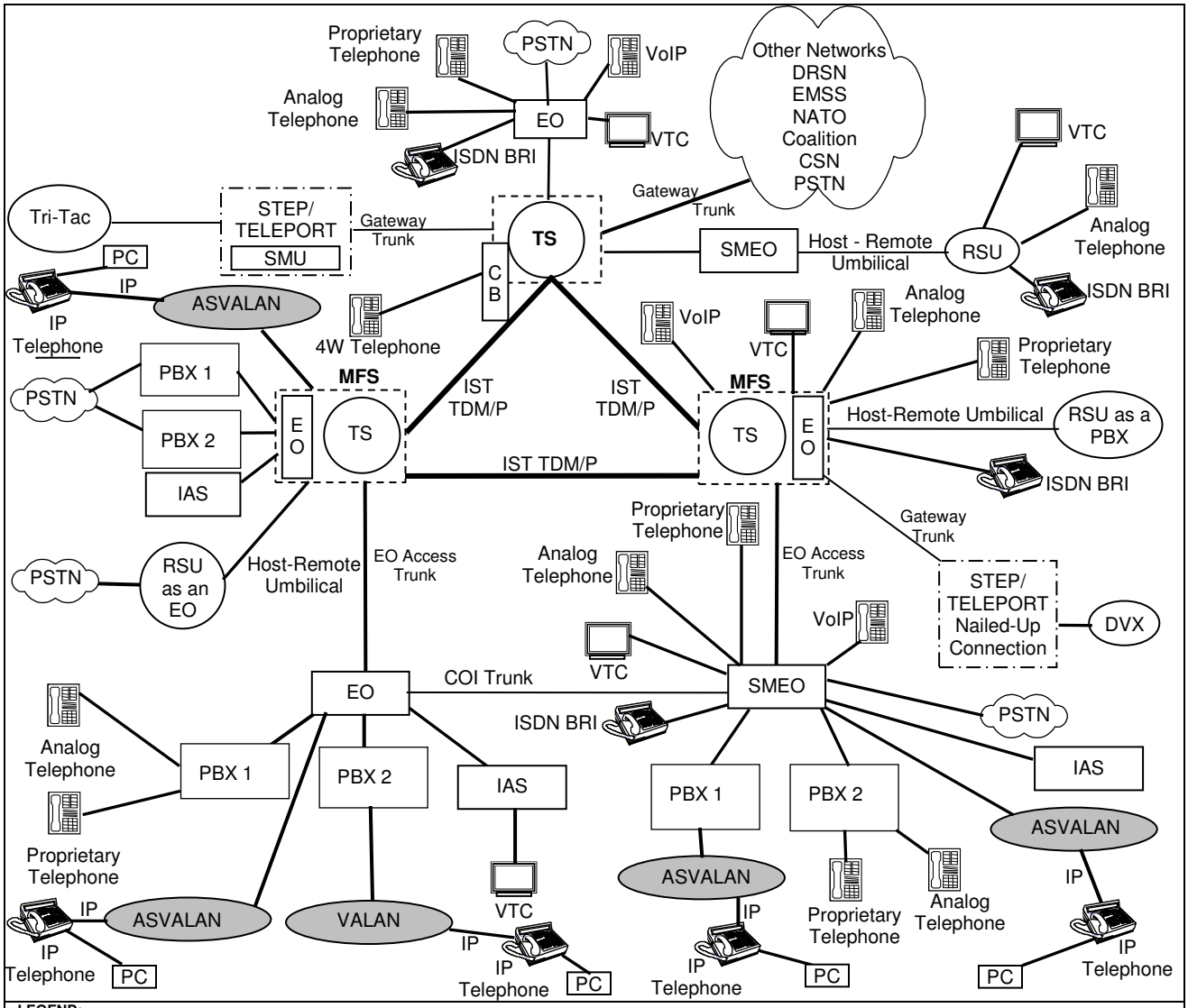
The Nortel ERS8600 is a redundant chassis consisting of an ERS8610 chassis with ten-slot chassis, two slots for the ERS8692SF which act as the switch fabric and CPU, eight slots for network interfaces (NIs) and three power supply bays. The switch features ten-gigabit fiber and one-gigabit fiber NIs for connections between the core and distribution. Data and voice applications connect to the ASVALAN through the 10/100/1000BaseT and 1000baseFX Ethernet NIs.

The Nortel ERS8600 series family delivers a variety of port capacities from 32 to 48 copper ports. The ERS8600 series family does not provide Power over Ethernet (POE) switch blades. Triple-speed 10/100/1000 Megabits per second (Mbps) interfaces and 10 Gigabit uplinks are supported. The ERS8600 series supports Layer 2 (L2) and Internet Protocol version 4 (IPv4) Layer 3 (L3) switching. The fiber interfaces also support 1000BaseX optical transceivers.

The ERS5500 series switches are single-processor, single-supply, self-contained switches. Furthermore, an optional redundant DC power supply is available for this series of switches. The ERS5500 series family delivers a variety of port capacities from 24 to 48 copper ports. The ERS5500 series family delivers a variety of optical port capacities from 2 to 24 fiber ports. Some of the switches in this series provide POE. The ERS5500 switches utilized 1 Gigabit fiber links to the distribution layer and 1 Gigabit fiber or copper links to the Core layer. The ERS5500 switches also offer 10 Gigabit fiber links; however, due to excessive frame loss these interfaces are not certified by JITC nor authorized for use within the DSN by the Program Management Office (PMO). Although ERS5500 series switches are L3 capable, the tested configuration included only L2 traffic between the ERS5500 series switches and the distribution/core layers. Therefore, the ERS5500 series of switches are only certified for L2 switching.

The ERS4500 series switches are single-processor, single-supply, self-contained switches. Furthermore, an optional redundant DC power supply is available for this series of switches. The ERS4500 series family delivers a variety of port capacities from 24 to 48 copper ports. Some of the switches in this series provide POE. The ERS4500 series family delivers a variety of optical port capacities from 2 to 24 fiber ports of 100/1000baseFX. The ERS4500 switches utilized 1 Gigabit fiber links to the distribution layer. Although this ERS4500 series switches are L3 capable, the tested configuration included only L2 traffic between the ERS4500 series switches and the distribution layer. Therefore, the ERS4500 series of switches are only certified for L2 switching.

6. OPERATIONAL ARCHITECTURE. The DSN architecture is a two-level network hierarchy consisting of DSN backbone switches and Service/Agency installation switches. Service/Agency installation switches have been authorized to extend voice services over IP infrastructures. The Generic Switching Center Requirements (GSCR) operational DSN Architecture is depicted in figure 2-1, which depicts the relationship of the ASVALAN and VALAN to the DSN switch types. The installation ASVALAN VoIP architecture is depicted in figure 2-2 and the VALAN VoIP architecture is depicted in figure 2-3. The ASVALAN and VALAN combined VoIP architecture is depicted in figure 2-4.



LEGEND:

4W	- 4-Wire
ASVALAN	- Assured Services Voice Application Local Area Network
BRI	- Basic Rate Interface
CB	- Channel Bank
COI	- Community of Interest
CSN	- Canadian Switch Network
DRSN	- Defense Red Switch Network
DSN	- Defense Switch Network
DVX	- Deployable Voice Exchange
EMSS	- Enhanced Mobile Satellite System
EO	- End Office
IAS	- Integrated Access Switch
IP	- Internet Protocol
ISDN	- Integrated Services Digital Network
IST	- Interswitch Trunk
MFS	- Multifunction Switch
NATO	- North Atlantic Treaty Organization
PBX	- Private Branch Exchange
PBX 1	- Private Branch Exchange 1
PBX 2	- Private Branch Exchange 2
PC	- Personal Computer
PSTN	- Public Switched Telephone Network
RSU	- Remote Switching Unit
SMEO	- Small End Office
SMU	- Switched Multiplex Unit
STEP	- Standardized Tactical Entry Point
TDM/P	- Time Division Multiplex/Packetized
Tri-Tac	- Tri-Service Tactical Communications Program
TS	- Tandem Switch
VALAN	- Voice Application Local Area Network
VoIP	- Voice over Internet Protocol
VTC	- Video Teleconferencing
	- System Under Test

Figure 2-1. DSN Architecture

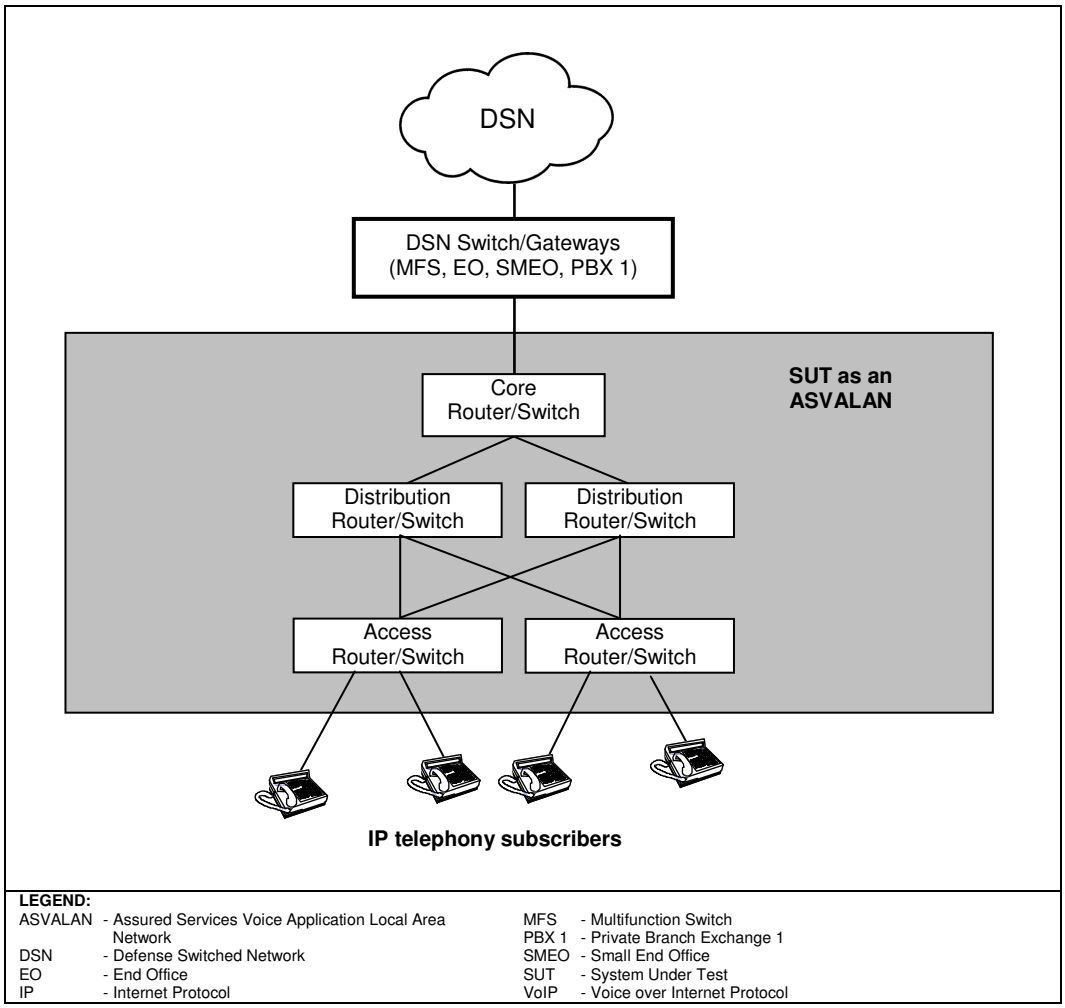
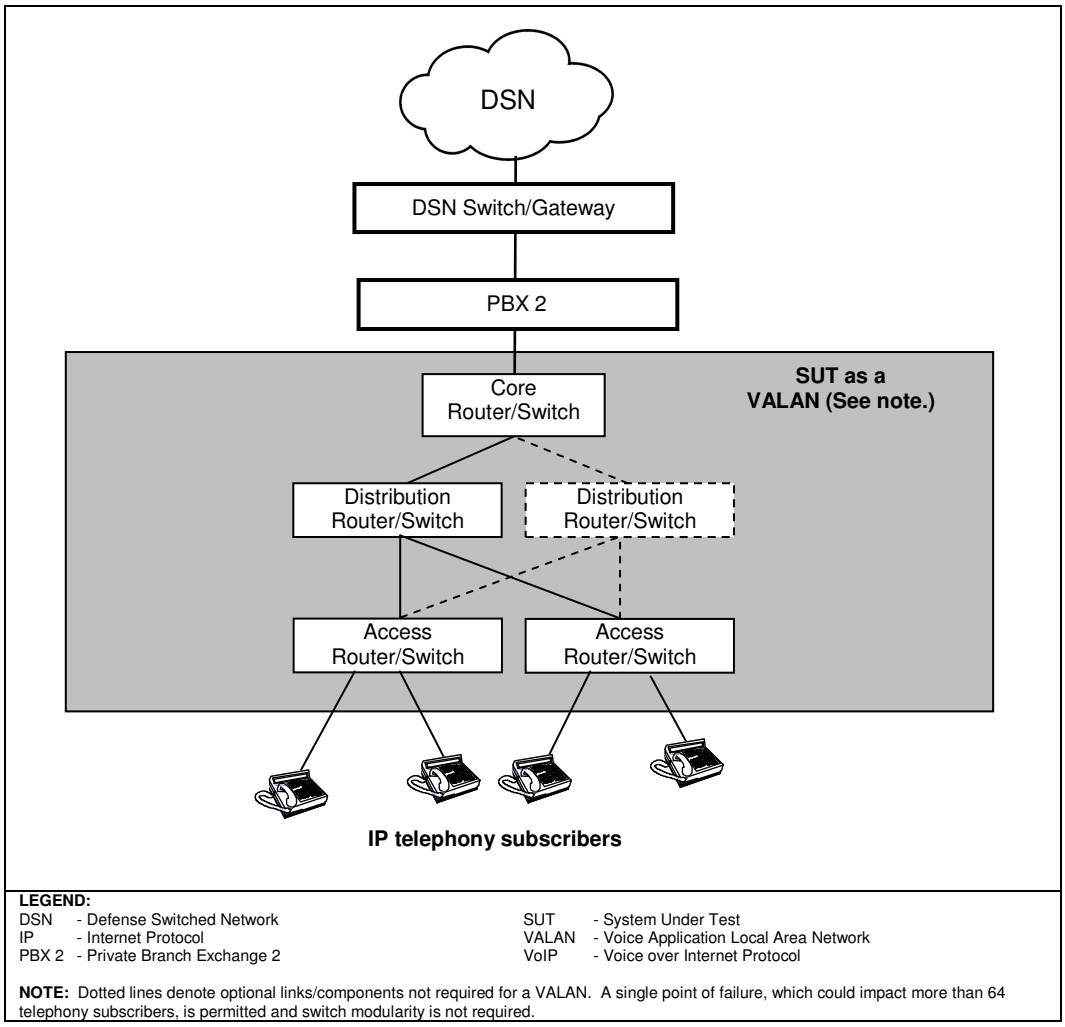


Figure 2-2. ASVALAN VoIP Architecture

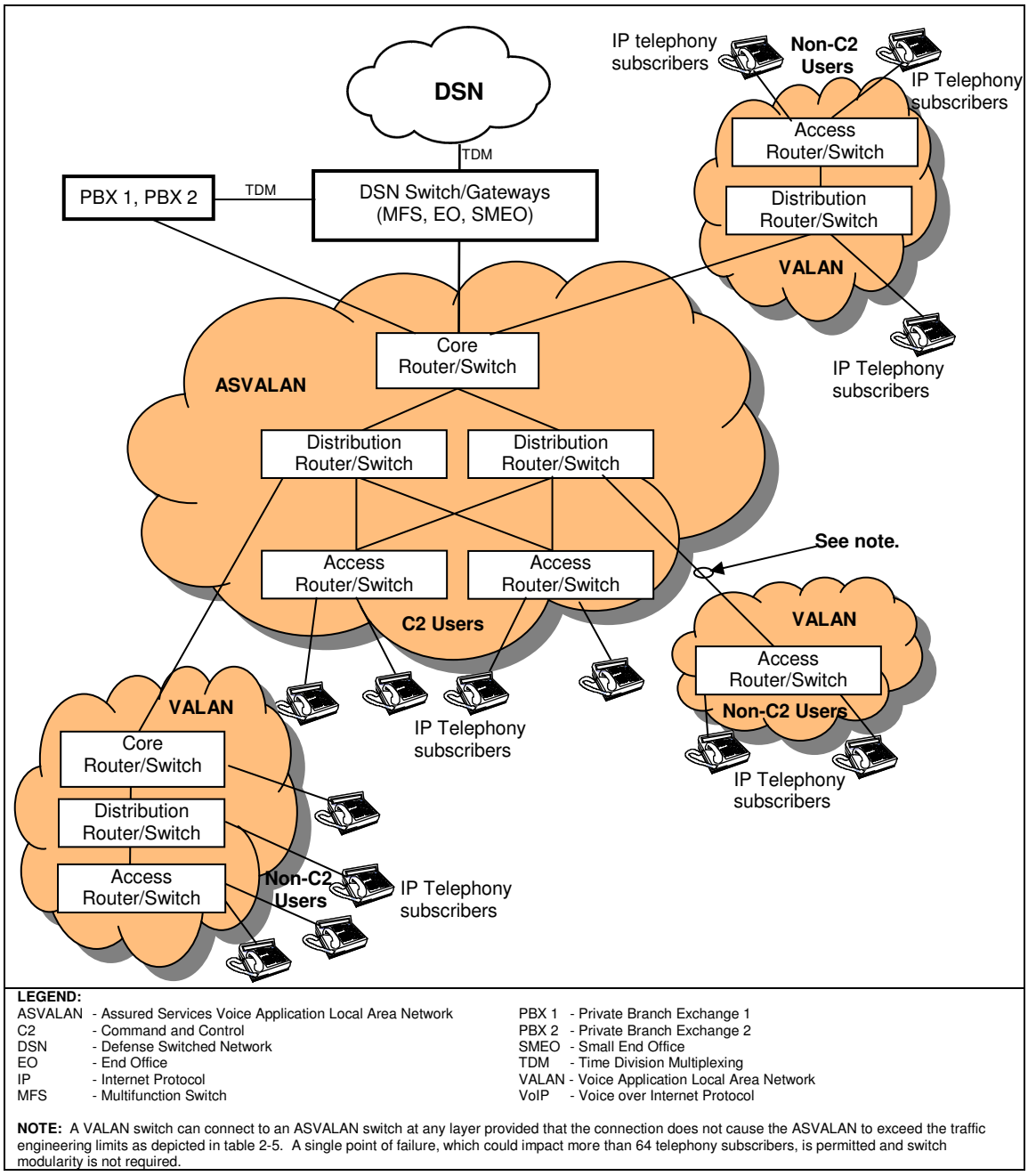


LEGEND:

DSN	- Defense Switched Network	SUT	- System Under Test
IP	- Internet Protocol	VALAN	- Voice Application Local Area Network
PBX 2	- Private Branch Exchange 2	VoIP	- Voice over Internet Protocol

NOTE: Dotted lines denote optional links/components not required for a VALAN. A single point of failure, which could impact more than 64 telephony subscribers, is permitted and switch modularity is not required.

Figure 2-3. VALAN VoIP Architecture



LEGEND:

ASVALAN	- Assured Services Voice Application Local Area Network	PBX 1	- Private Branch Exchange 1
C2	- Command and Control	PBX 2	- Private Branch Exchange 2
DSN	- Defense Switched Network	SMEO	- Small End Office
EO	- End Office	TDM	- Time Division Multiplexing
IP	- Internet Protocol	VALAN	- Voice Application Local Area Network
MFS	- Multifunction Switch	VoIP	- Voice over Internet Protocol

NOTE: A VALAN switch can connect to an ASVALAN switch at any layer provided that the connection does not cause the ASVALAN to exceed the traffic engineering limits as depicted in table 2-5. A single point of failure, which could impact more than 64 telephony subscribers, is permitted and switch modularity is not required.

Figure 2-4. ASVALAN and VALAN Combined VoIP Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT ASVALAN and VALAN system requirements are listed in table 2-1. The requirements specific to the SUT ASVALAN and VALAN components are shown in table 2-2. These requirements are derived from:

a. DSN services for Network and Applications specified in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01C, "Policy for Department of Defense Voice Services with Real Time Services (RTS)."

b. GSCR, appendix 3, Capability Requirements (CRs) and Feature Requirements (FRs) verified through JITC testing and/or vendor submission of Letters of Compliance (LoC).

Table 2-1. ASVALAN and VALAN System Requirements

System Requirements				
Requirement	**Criteria**		**Reference**	**Required**
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.3	Yes
Reliability	ASVALAN	- ASVALANs shall have a reliability of .99999 - No single point of failure for outage of more than 64 telephony subscribers - Network Path restores within 5 seconds	GSCR, Appendix 3, Section A.3.3.4.1, UCR, Appendix 3 A3.3.9.3	Yes
	VALAN	- This requirement is conditional for a VALAN.	GSCR, Appendix 3, paragraph A.3.3.4.1	No
IPv6[1]	All IP devices shall be IPv6 capable.		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
Security[2]	DIACAP (replacement for DITSCAP)/IA		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes

LEGEND:

ASVALAN - Assured Services Voice Application LAN
DIACAP - DoD IA Certification and Accreditation Process
DISA - Defense Information Systems Agency
DITSCAP - DoD IT Security Certification and Accreditation Process
DoD - Department of Defense
GSCR - Generic Switching Center Requirements
IA - Information Assurance
IP - Internet Protocol
IPv4 - Internet Protocol version 4
IPv6 - Internet Protocol version 6
IT - Information Technology
LAN - Local Area Network
ms - milliseconds
UCR - Unified Capabilities Requirements
VALAN - Voice Application LAN

NOTES:

1 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria**:**
   a. Conformant with IPv6 standards profile contained in the DoD IT Standards Registry (DISR).
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

2 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2-2. ASVALAN and VALAN Component Requirements

Core/Distribution/Access Component Requirements				
Requirement	**Criteria**		**Reference**	**Required**
CoS Models	LAN components shall support IEEE 802.1p to DSCP mapping and at least one of the following: - IEEE 802.1p/Q priority tagging/VLAN tagging - DSCP - ToS		GSCR, Appendix 3, paragraph A.3.3.2.1	Yes
Traffic Prioritization	Traffic within LAN components shall be prioritized so that voice signaling receives highest priority, voice media second highest priority, and data lowest priority.		GSCR, Appendix 3, paragraph A.3.3.2.2	Yes
QoS	LAN components shall support one of the following: - Priority Queuing - Custom Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing		GSCR, Appendix 3, paragraph A.3.3.3.1	Yes
Policing	LAN components shall support one of the following: - DSCP PHB - Generic Traffic Shaping - Class-Based Shaping		GSCR, Appendix 3, paragraph A.3.3.3.2	Yes
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Protocol based VLANs		GSCR, Appendix 3, paragraph A.3.3.3.3	Yes
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol		GSCR, Appendix 3, paragraph A.3.3.4	Yes
Reliability	ASVALAN	LAN components shall support: - ASVALAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 telephony subscribers) - N+1 sparing for access (more than 64 telephony subscribers) - Redundancy protocol[1] - 5 second path restoral	GSCR, Appendix 3, Section A.3.3.4.1 UCR, Appendix 3 A3.3.9.3	Yes
	VALAN	This requirement is conditional for a VALAN.	GSCR, Appendix 3, paragraph A.3.3.4.1	No
Network Management	ASVALAN	LAN components shall support: - In-band or out-of-band management - SNMP - Measurements	GSCR, Appendix 3, paragraph A.3.3.4.2	Yes
	VALAN	This requirement is conditional for a VALAN.	GSCR, Appendix 3, paragraph A.3.3.4.2	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs.[2]		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes
IPv6	All IP devices shall be IPv6 capable.[3]		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
TE	ASVALAN	- ASVALAN components shall be engineered for a maximum of 25% voice traffic per link.[4] - For more than 64 telephony subscribers, link pairs (redundant links) must be used.	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes
	VALAN	VALAN components shall be engineered for a maximum of 25% voice traffic per link.[4]	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes

Table 2-2. ASVALAN and VALAN Component Requirements (continued)

LEGEND:

802.1d	- Standard for Local and Metropolitan Area Networks: MAC Bridges
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization
802.1Q	- Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks
802.1s	- Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees
802.1v	- Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition)
802.1w	- Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration
802.1x	- Standard for Local and Metropolitan Area Networks Port-Based Network Access Control
802.3ad	- Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications–Aggregation of Multiple Link Segments
ASVALAN	- Assured Services Voice Application LAN
CoS	- Class of Service
DISA	- Defense Information Systems Agency
DSCP	- Differentiated Services Code Point
GSCR	- Generic Switching Center Requirements
IEEE	- Institute of Electrical and Electronics Engineers
IP	- Internet Protocol
IPv4	- Internet Protocol version 4
IPv6	- Internet Protocol version 6
LAN	- Local Area Network
MAC	- Media Access Control
Mbps	- Megabits per second
N	- total VoIP users / 64
OSPFV.3	- Open Shortest-Path First Version 3
PHB	- Per Hop Behaviors
QoS	- Quality of Service
SNMP	- Simple Network Management Protocol
STIGs	- Security Technical Implementation Guides
TE	- Traffic Engineering
ToS	- Type of Service
UCR	- Unified Capabilities Requirements
VALAN	- Voice Application LAN
VLANs	- Virtual LANs
VoIP	- Voice over Internet Protocol
VRRP	- Virtual Router Redundancy Protocol

NOTES:

1 For core and distribution components, OSPFV.3 redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol.

2 Verified using the Information Assurance Test Plan. Results of the security testing are published in a separate test report generated by the DISA Information Assurance test personnel.

3 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria:
   a. Conformant with IPv6 standards profile contained in the Department of Defense Information Technology Standards Registry (DISR).
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

4 Instruments connected to an access device must provide a minimum of a 10 Mbps full duplex link. For core and distribution connections, the minimum link capacity is 100 Mbps full duplex. Actual voice media and signaling traffic is less than 50 Mbps for an access stack of eight switches.

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. Figures 2-5 and 2-6 depict the SUT test configurations.

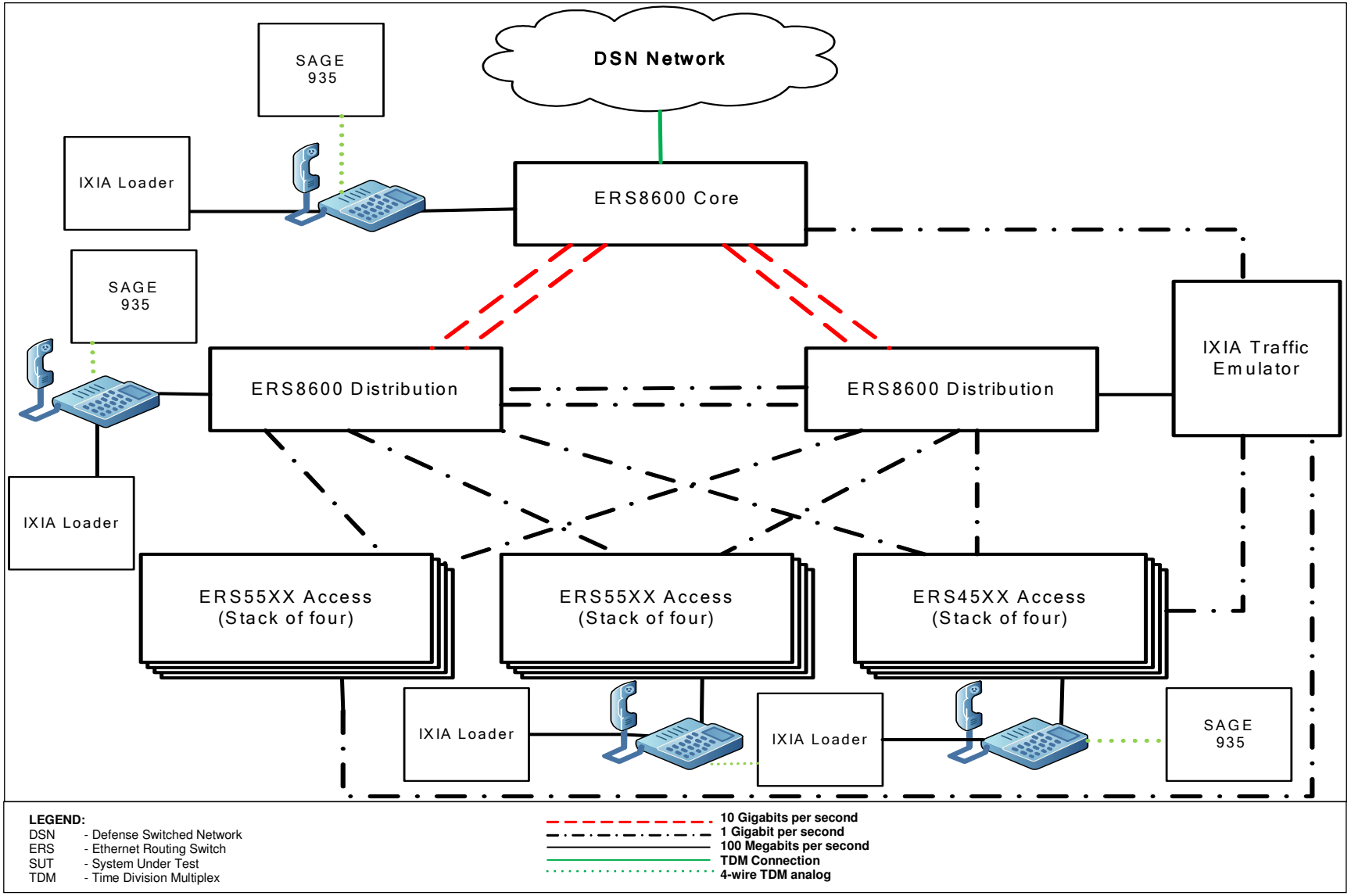


Figure 2-5. SUT Test Configuration with ERS5530 Switch as Access Only

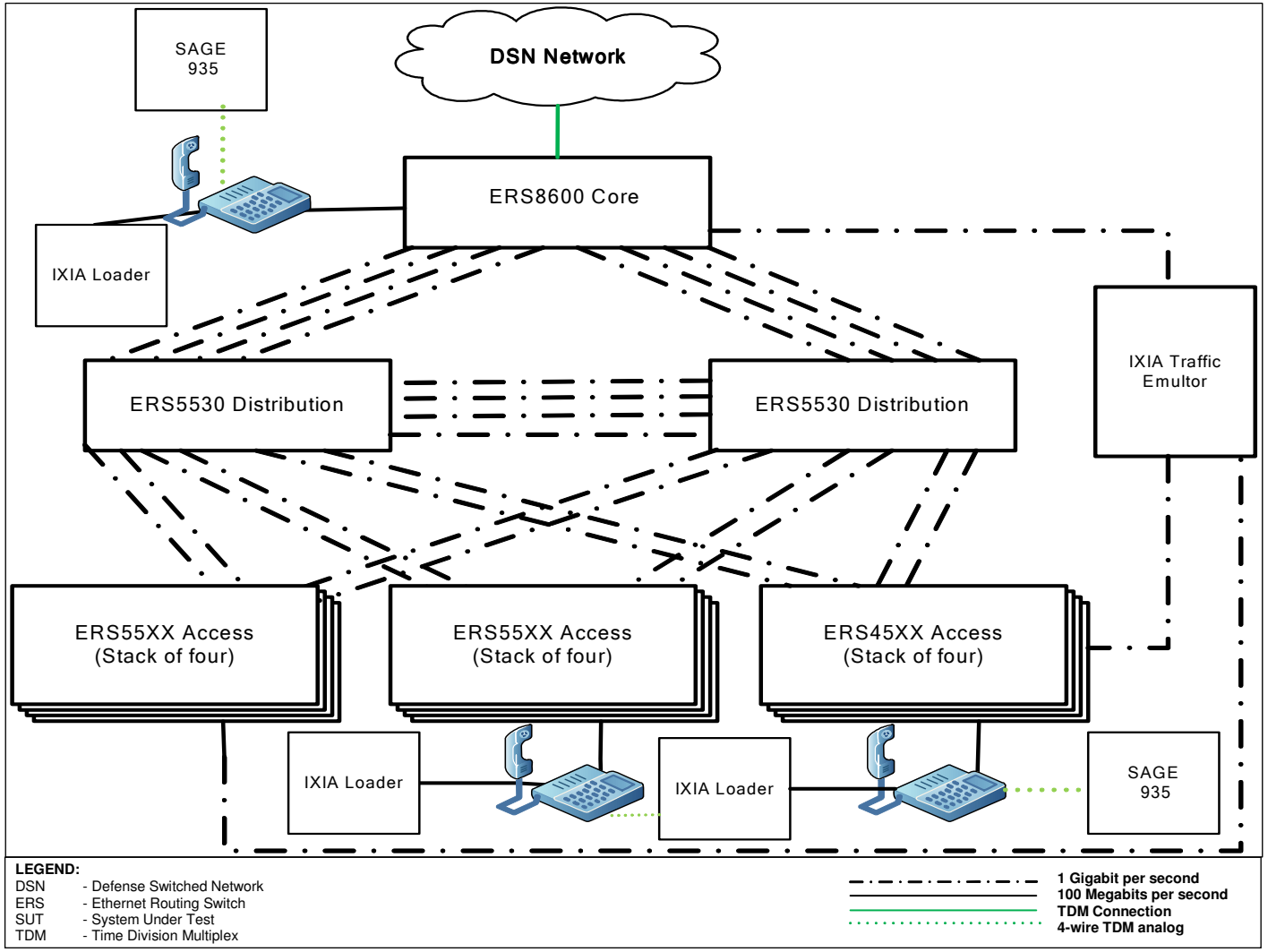


Figure 2-6. SUT Test Configuration with ERS 5530 Switch as Distribution

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the system configurations, hardware and software components tested with the SUT. The SUT was tested in an operationally realistic environment to determine interoperability with the DSN switch noted in table 2-3. The DSN switch listed in table 2-3 only depicts the tested configuration. Table 2-3 is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the DSN APL that are certified for use with an ASVALAN or VALAN.

Table 2-3. Tested System Configurations

System Name	Software Release		
Nortel CS2100	Succession Enterprise (SE) 09.1		
System Under Test Components with Current Operating System			
Component (See note 1.)	**Release**	**Sub-component (See note 1.)**	**Function**
ERS8610, ERS8606	4.1.4	**ERS8692SF, ERS8692SF**[2]	CPU and switch fabric blade
		ERS8683XLR, ERS8683XZR	3-port 10 Gigabit Ethernet Network Interface blade
		ER8648GTR, ERS8630GB	**48-port 1 Gigabit Ethernet Network Interface blade** and 30 port GBIC blade
		ERS8005DC, ERS8005AC, **ERS8004AC**	Redundant DC and AC power supply
ERS5530-24TFD, ERS5520-48T, 5520-24T, 5510-48T, 5510-24T	Firmware 5.0.0.4 Software 5.0.6.207	Not Applicable	Not Applicable
ERS4548GT-PWR, ERS4548GT, **ERS4550T-PWR,** ERS4550T, **ERS4526FX**	Firmware 5.0.1.0 Software 5.0.1.209	Not Applicable	Not Applicable

LEGEND:

AC	- Alternating Current	GBIC	- Gigabit Interface Converter
CPU	- Central Processing Unit	GTR	- Gigabit base T
CS	- Communication Server	IPv6	- Internet Protocol version 6
DC	- Direct Current	JITC	- Joint Interoperability Test Command
ERS	- Ethernet Routing Switch	PWR	- Power over Ethernet
FD	- Fiber distribution	SF	- Switch Fabric
FX	- 100BaseFX fiber	T	- Base T
G	- Gigabit	XLR	- 10 G XFP Long Range
GB	- GBIC interface		

NOTES:
1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.
2 This card includes a daughter board which provides enhanced IPv6 performance. However, IPv6 capability was not tested, it was satisfied by the vendor's Letter of Compliance.

10. TESTING LIMITATIONS. None.

11. TEST RESULTS

a. Components. The SUT met the minimum interoperability requirements of the GSCR, appendix 3, for an ASVALAN. If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN. The network consisted of three main components: core, distribution, and access switches. The test results are provided below.

(1) Class of Service (CoS). The GSCR, appendix 3, section A3.3.2, outlines several methodologies to implement CoS. The SUT employed Institute of Electrical and Electronics Engineers (IEEE) 802.1p/Q at the Data Link Layer (L2) and Differentiated Services Code Point (DSCP) at the Network Layer (L3) and 802.1p/Q to DSCP mapping, which was verified by capturing packets at both layers within the network.

(2) Traffic Prioritization. Priorities were applied in accordance with the CoS listed above. The applied priorities ensured voice signaling would get the highest level of priority; voice media stream would be prioritized lower than voice signaling but higher than data, and data traffic would receive the lowest priority. At L2, packets were tagged as: Data traffic = 0, Voice media = 5 and Voice Signaling and Network Management = 6, for L3 prioritization, DSCP were marked 0, 46, and 48 respectively. The Ixia filled uplinks to capacity with data packets tagged at 0, voice packets were transmitted and tagged with 46 for voice media and 48 for voice signaling. The packets were placed in a higher queue and were not delayed throughout the network. 802.1q tagged ports are automatically trusted. However, “trust qos” statements were applied on ports. By filling uplinks to capacity with data packets tagged at 0, voice packets were transmitted and tagged with 5 and 6. The packets received the correct precedence and were not delayed.

In addition, flooding parameters were set to prevent broadcast and multicast traffic from overwhelming the ports. Broadcast and multicasts limits were set to no greater then 10 percent on 10 Gigabits links, 50 percent on 1 Gigabit links, and 50 percent on 10/100/1000 Mbps ports. The configuration changes that were made to ensure proper operation can be found on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

(3) QoS. The SUT utilizes 8 queues and uses Strict Queuing and Weighted Fair Queuing. Packets tagged with a CoS of 6 are queued in a highest priority queue. The CoS values of 5 and 0 are placed in separate queues, with 5 receiving a higher value therefore, it will be serviced more frequently then 0. These tags were used to identify and separate traffic types that pass through the network connections ensuring that signaling traffic and voice traffic take precedence over data traffic.

The GSCR, appendix 3, paragraph 3.3.3.1, outlines that an ASVALAN must support at least one of the following queuing mechanisms: Priority Queuing, Custom Queuing, Weighted Fair Queuing, or Class-Based Weighted Fair Queuing. The SUT supports all of the queuing mechanisms; however, Strict Queuing and Weighted Fair Queuing were utilized for this test. Both Strict Queuing and Weighted Fair Queuing support queues from high to low. All packets of a higher priority queue will be transmitted before any packets from a lower priority queue. Queues are serviced in order of queue priority. The highest queue gets serviced first and then the next lower priority queue. If a lower priority queue is being serviced and a packet in the higher queue enters the higher queue, the higher priority queue gets serviced immediately after the current packet from the lower queue is sent. Then, once the higher priority queue is empty; the lower priority queue continues being serviced. Layer 2 packets

tagged with a CoS of 6 are queued in the highest priority queue. The CoS values 5 and 0 are serviced in separate queues, with 5 receiving a higher value therefore, the CoS value of 5 will be serviced more frequently then 0. These tags are used to identify and separate traffic types as the packets pass through network connections ensuring voice traffic takes precedence over data traffic.

(4) Policing. Traffic Policing limits the ingress or egress transmission rate of a class of traffic based on user-defined criteria and marks packets by setting the IP Precedence value, the QoS group, or the DSCP value. The GSCR, appendix 3, paragraph A3.3.3.2, outlines that the ASVALAN must meet at least one of the following policing mechanisms: DiffServ Per-Hop Behavior (PHB), Generic Traffic Shaping (GTS), or Class-Based Shaping (CBS). The SUT implemented DiffServ PHB which uses DSCP values to define how traffic is treated at each individual node. DSCP values are used from the L3 IP header. Traffic sharing a common DSCP header is known as a forwarding class. The forwarding behavior applied by a DiffServ-compliant node to each forwarding class is known as PHB. The DiffServ domain marks the DSCP values in packets so they can be routed to the same PHB on the next forwarding nodes until the packet reaches the final destination or leaves the DiffServ domain. Accurate metering, policing and shaping protect the DiffServ domain from excessive traffic loading. The DiffServ PHBs map directly to the internal forwarding classes along the path of the packet.

- Expedited Forwarding (EF) classes enjoy a premium forwarding status above all other classes. Other forwarding classes cannot affect the latency or jitter experienced by traffic in these premium classes. The EF PHB allows unlimited preemption of other traffic, the implementation limits damage EF traffic inflicts on other traffic. Voice signaling Packets with a DSCP value 48 are placed in the EF class.

- Assured Forwarding class packets transmitted through the queue at or below the committed transmission rate are marked “in-profile.” Voice media packets use a DSCP value of 46, and are placed in the Assured Forwarding queue. If sufficient bandwidth is available along the path for assured traffic, packets will reach their destination. Packets transmitted out of the service queue that are above the committed rate and reach congestion in the network, are discarded before “in-profile” assured service packets.

- Best Effort Forwarding packets are lower priority packets and are forwarded after Expedited and Assured Forwarding packets have been forwarded.

(5) Virtual LAN (VLAN). The GSCR, appendix 3, paragraph A3.3.3.3 outlines that the ASVALAN shall support either implicit or explicit VLAN membership for: Port-based VLANs, Media Access Control (MAC) address-based VLANs, or L3 protocol-based VLANs. The SUT supports port-based VLANs. Switches within the topology were configured with multiple VLANs using the IEEE 802.1Q tag to separate data from voice traffic. MAC address and Protocol-based VLANs were verified through the LoC as well as packet captures.

(6) IEEE Conformance. All aspects of IEEE conformance were met through the LoC or testing. All test results are discussed under their respective topics.

(7) Reliability. The GSCR, appendix 3, section A3.3.4.1, requires that there be no single point of failure within the ASVALAN that can cause an outage of more than 64 telephony subscribers. In order to meet the availability requirement of an ASVALAN, all switching/routing platforms that offer more than 64 telephony subscribers shall have a switch design or configuration that provides at a minimum dual power supplies, dual processors, redundancy protocol, and switch fabric redundancy. To meet the reliability requirements, dual Gigabit and/or 10 Gigabit Link Aggregation was configured between the core and distribution switches, and dual Gigabit and/or 10 Gigabit L2 rapid spanning tree links connected the distribution and access switches. The link aggregation from the distribution to the core must be terminated onto separate fiber cards at the core switch. Reliability is a conditional requirement for a VALAN.

(8) Network Management. The GSCR, appendix 3, paragraph A3.3.4.2, requires that the vendor provide a management system to monitor the performance of the ASVALAN portion of the VoIP system. Due to numerous third party systems and applications capable of performing this function, this requirement was verified via LoC. Network Management features are conditional requirements for a VALAN.

(9) Security. Security requirements in accordance with the GSCR, appendix 3, paragraph A3.3.4.3, were verified using the Information Assurance Test Plan. Results of the security testing are reported in a separate test report generated by the Defense Information Systems Agency (DISA) Information Assurance test personnel.

(10) Internet Protocol version 6 (IPv6). An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 interoperability was not tested with the SUT. IPv6 capability is currently satisfied by testing and a vendor Letter of Compliance signed by the Vice President of the company. The vendor stated, in writing, compliance to the following criteria:

(a) Conformant with IPv6 standards profile contained in the Department of Defense (DoD) Information Technology Standards Registry (DISR).

(b) Maintaining interoperability in heterogeneous environments and with IPv4.

(c) Commitment to upgrade as the IPv6 standard evolves.

(d) Availability of contractor/vendor IPv6 technical support.

Open Shortest-Path First version 3 (OSPF V.3) was enabled during the tests. OSPF V.3 was required for IPv6 compatibility. All of the SUT components covered under this certification met the IPv4 criteria through testing. All of the SUT components covered under this certification met the IPv6 criteria via letter of compliance.

(11) Traffic Engineering

(a) Links. To meet the ASVALAN requirements, all links connected between the core and distribution are configured as Link Pairs or Groups. To meet the ASVALAN requirements for failover, all links connected between the core and distribution and between distribution switches were configured as shown in figures 2-5 and 2-6. The link Pairs and Groups between the core and distribution are terminated on two separate fiber cards at each switch with the exception of the ERS5530-24TFD. When the ERS5530-24TFD is used as a distribution, uplink capacity needs to be engineered for at least 25 percent of the total traffic entering the ERS5530-24TFD switch. If the engineered capacity of the uplink is sized for less than 25 percent of the total traffic entering the ERS5530-24TFD switch, then excessive voice media packet loss will occur. Furthermore, when the ERS5530-24TFD switch is used as a distribution switch, due to excessive voice media packet loss it can not have end user devices, such as IP phones and computers physically connected to it. Access stacks composed of 55XX and 45XX switches must be engineered for an uplink capacity of at least 50 percent of the total traffic.

(b) Scalability. The SUT can be scaled to meet any number of IP phone subscribers as long as the SUT is composed of the equipment and software listed in table 2-3, and are consistent with traffic engineering constraints contained in the GSCR, appendix 3. Table 2-4, which was approved by the DSN Configuration Control Board (DSN CCB) on Dec 2004, outlines the maximum number of subscribers that can be supported per each link capacity.

Table 2-4. IP Subscriber Supportability by Link Capacity

Link Type	LAN BW	Users
Non-Converged	10 Mbps	64 (See note 1.)
	100 Mbps	64 (See note 1.)
	1 Gbps	64 (See note 1.)
	10 Gbps	64 (See note 1.)
	10 Mbps LP	100 (See note 2.)
	100 Mbps LP	1000 (See note 2.)
	1 Gbps LP	10000 (See note 2.)
	10 Gbps LP	100000 (See note 2.)

Table 2-4. IP Subscriber Supportability by Link Capacity (continued)

Link Type	LAN BW	Users
Converged	10 Mbps	25 (See note 3.)
	100 Mbps	64 (See note 1.)
	1 Gbps	64 (See note 1.)
	10 Gbps	64 (See note 1.)
	10 Mbps LP	25 (See note 3.)
	100 Mbps LP	250 (See note 4.)
	1 Gbps LP	2500 (See note 4.)
	10 Gbps LP	25000 (See note 4.)

LEGEND:

ASVALAN	- Assured Services Voice Application LAN	kbps	- kilobits per second
BW	- Bandwidth	LAN	- Local Area Network
Gbps	- Gigabits per second	LP	- Link Pair
IP	- Internet Protocol	Mbps	- Megabits per second

NOTES:

1 For single links, number of telephony subscribers is limited to a maximum of 64 because of single point of failure requirements. This limit applies specifically to ASVALANs.
2 The number of users is calculated as bandwidth (BW) divided by 100 kbps per user.
3 The number of users was limited to 64 telephony subscribers per note 1 or 25% of total users per note 1, whichever was less.
4 For the converged network, voice traffic was engineered not to exceed 25 % of total utilization using an estimated 100 kbps per voice call.

(12) LAN Architectures. The ERS8600 series is certified in the core, distribution, and access layers when deployed as a component in an ASVALAN or VALAN. The ERS8600 series was tested with 100/1000/10000 Mbps data load. The ERS5500 series and ERS4500 series switches are certified in the access layer when deployed as a component in an ASVALAN or VALAN. The ERS5500 series switches are certified in the distribution layer when deployed as a component in an ASVALAN or VALAN only with dual power supplies. Furthermore, the ERS5500 series switches utilized 1 Gigabit fiber links to the distribution layer and 1 Gigabit fiber or copper links to the Core layer. The ERS5500 switches also offer 10 Gigabit fiber links; however, due to excessive frame loss these interfaces are not certified by JITC nor authorized for use within the DSN by the PMO. The ERS4500 series and ERS5500 series switches are authorized for use in the access layer as standalone units. The ERS4500 series and ERS5500 series switches are also authorized for use in the access layer in a stacked configuration when the uplink switches are equipped with dual power supplies.

Shared access (i.e., same switch port is shared by Personal Computer and IP phone), was tested and is certified with the SUT for speeds up to 1000 Mbps full duplex. To test 100 Mbps shared access, the IP phones were connected to the 100 Mbps full duplex access switch port and data was generated on the 100 Mbps full duplex Ethernet port on the back of the phones using an IXIA test set. 1000 Mbps ports were tested with the Ixia, which generated 12 percent prioritized UDP traffic and 87 percent non-prioritized TCP traffic with the ERS8600 distribution switches. 1000 Mbps ports were tested with the Ixia, which generated 4 percent prioritized UDP traffic and 96 percent non-prioritized TCP traffic with the ERS5530 distribution switches. All SUT switches, with the exception of the ERS5530-24TFD distribution, which provide Ethernet access ports in this certification, were tested for shared access with no measurable degradation of voice quality. Voice signaling, voice media and data packets were properly queued by the SUT.

Although IPv6 was not evaluated, OSPF V.3 was implemented between the core and 8600 distribution layers. Dual stack was implemented at the core and 8600 distribution. To meet the ASVALAN failover requirements OSPF V.2 (IPv4) and OSPF V.3 (IPv6) utilizes link-state protocols to identify lowest cost paths within the LAN. Additionally, OSPF V.3 is an open standard, and is a common protocol between different vendors equipment. The ASVALAN depicted in figure 2-6 did not have OSPF enabled between the access layer dual stack and the distribution layer.

(a) Delay. The GSCR, appendix 3, section A3.3.1.1, states the one-way packet delay shall be five milliseconds (ms) or less, as measured over a five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between the access and core devices, was 0.03 ms, with a maximum delay of 1 ms.

(b) Jitter. The GSCR, appendix 3, section A3.3.1.2 states jitter for voice media packets will be 5 ms or less as averaged over any five-minute period. With a 100% bandwidth load, jitter was measured to be 2 ms or less over a five-minute period.

(c) Packet Loss. Network packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 3, section A3.3.1.3, states that LANs shall be engineered so the measured voice packet loss within the LAN shall not exceed 0.05 percent averaged over any five-minute period. With 100 percent bandwidth load, the measured packet loss was 0.0 percent as measured by the SAGE 935AT and Ixia.

b. System Interoperability Results. The SUT is certified for joint use within the DSN with the Digital Switching Systems listed on the DSN Networks APL which are certified for use with an ASVALAN or VALAN. The SUT is certified to support DSN Assured Services over IP as an ASVALAN in accordance with the requirements set forth in the GSCR, appendix 3. The SUT is also certified as a VALAN. However, since VALANs do not support the Assured Services Requirements detailed in reference (c), Command and Control (C2) users and Special C2 users are not authorized to be served by a VALAN. Since VALANs do not support Assured Services, they can only serve DoD, non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. VALAN connectivity to the DSN is not authorized until a waiver is granted by the Joint Staff for each site. The system interoperability test summary is shown in table 2-5 and the detailed component interoperability test status is shown table 2-6.

Table 2-5. SUT System Interoperability Test Summary

Device Requirement[1]	Reference	Test Results	Remarks
Delay measured at 5 ms or less	GSCR, Appendix 3, A3.3.1.1	Met	The average was 0.03 ms and the maximum was 1.0 ms.
Jitter measured at less than 5 ms	GSCR, Appendix 3, A3.3.1.2	Met	Measured to be 2.0 ms or less.
Packet Loss less than 0.05%	GSCR, Appendix 3, A3.3.1.3	Met	Measured to be 0.00%.
Reliability	GSCR, Appendix 3, Section A.3.3.4.1	Met	See note 2.
IPv6	GSCR, Appendix 3, Section A3.2.8	Met	See note 3.
Security	GSCR, Appendix 3, A3.2.4	Met	See note 4.

LEGEND:

ASVALAN	- Assured Services Voice Application Local Area Network	IPv4	- Internet Protocol version 4
DISA	- Defense Information Systems Agency	IPv6	- Internet Protocol version 6
DISR	- DoD Information Technology Standards Registry	ms	- millisecond
DoD	- Department of Defense	SUT	- System Under Test
GSCR	- Generic Switching Center Requirements	VALAN	- Voice Application Local Area Network

NOTES:

1 If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN.

2 Reliability is a conditional requirement for a VALAN.

3 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria:
   a. Conformant with IPv6 standards profile contained in the DISR.
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

4 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

Table 2-6. Component Interoperability Test Summary

DSN Line Interfaces						
Interface	**Component (See note 1.)**	**Status**	**Device Requirement**	**Test Results**	**Reference**	**Remarks**
1000/10000 BaseFX 10/100/1000 BaseTX	**ERS8610,** ERS8606	Certified as: Core Distribution Access	CoS Models	Met	GSCR, Appendix 3, A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, A3.3.3	
			Policing	Met	GSCR, Appendix 3, A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1 UCR, Appendix 3 A3.3.9.3	Reliability is a conditional requirement for a VALAN.[2]
			Network Management	Met	GSCR, Appendix 3, A.3.3.4.2	Network Management is not a requirement for a VALAN.[2]
			Security	Met	GSCR, Appendix 3, A.3.3.4.3	See note 3.
			IPv6	Met	GSCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	GSCR, Appendix 3, A.3.3.4.4	For a VALAN, redundant links are not required.[2]
1000Base TX/SX	**ERS5530-24TFD**	Certified as: Distribution[5]	CoS Models	Met	GSCR, Appendix 3, A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, A3.3.3	
			Policing	Met	GSCR, Appendix 3, A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, A3.3.4	
			Reliability	Met	GSCR, Appendix 3, A3.3.4.1	Reliability is a conditional requirement for a VALAN.[2]
			Network Management	Met	GSCR, Appendix 3, A.3.3.4.2	Network Management is not a requirement for a VALAN.[2]
			Security	Met	GSCR, Appendix 3, A.3.3.4.3	See note 3.
			IPv6	Met	GSCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	GSCR, Appendix 3, A.3.3.4.4	For a VALAN, redundant links are not required.[2]

Table 2-6. Component Interoperability Test Summary (continued)

DSN Line Interfaces						
Interface	**Component**[1]	**Status**	**Device Requirement**	**Test Results**	**Reference**	**Remarks**
100/1000 Base FX/SX 10/100/1000 BaseTX	**ERS4548GT-PWR** ERS4548GT **ERS4550T-PWR** ERS4550T **ERS4526FX**	Certified as: Access[6]	CoS Models	Met	GSCR, Appendix 3, paragraph A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, paragraph A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, paragraph A3.3.3.1	
			Policing	Met	GSCR, Appendix 3, paragraph A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, paragraph A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, paragraph A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1 UCR, Appendix 3 A3.3.9.3	A VALAN requires no redundancy and only .999 reliability.[2]
			Network Management	Met	GSCR, Appendix 3, paragraph A.3.3.4.2	Network Management is not a requirement for a VALAN.[2]
			Security	Met	GSCR, Appendix 3, paragraph A.3.3.4.3	See note 3.
			IPv6	Met	GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	See note 4.
			TE	Met	GSCR, Appendix 3, paragraph A.3.3.4.4	For a VALAN, redundant links are not required.[2]
100/1000 Base FX/SX 10/100/1000 BaseTX	**ERS5530-24TFD, 5520-48T**, 5520-24T, 5510-48T, 5510-24T	Certified as: Access[6]	CoS Models	Met	GSCR, Appendix 3, A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, A3.3.3	
			Policing	Met	GSCR, Appendix 3, A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1 UCR, Appendix 3 A3.3.9.3	Reliability is a conditional requirement for a VALAN.[2]
			Network Management	Met	GSCR, Appendix 3, A.3.3.4.2	Network Management is not a requirement for a VALAN.[2]
			Security	Met	GSCR, Appendix 3, A.3.3.4.3	See note 3.
			IPv6	Met	GSCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	GSCR, Appendix 3, A.3.3.4.4	For a VALAN, redundant links are not required.[2]

Table 2-6. Component Interoperability Test Summary (continued)

LEGEND:

10/100/1000BaseTX	- 100/1000/10000 Mbps Ethernet over Category 5 Twisted Pair Copper
100BaseFX	- 100 Mbps Ethernet over fiber
1000/10000BaseFX	- 1000/10000 Mbps Ethernet over fiber
ASVALAN	- Assured Services Voice Application Local Area Network
CoS	- Class of Service
DISA	- Defense Information Systems Agency
DISR	- DoD Information Technology Standards Registry
DSN	- Defense Switched Network
DoD	- Department of Defense
ERS	- Ethernet Routing Switch
FD	- Fiber Distribution
FX	- 100BaseFX fiber
G	- Gigabit
GSCR	- Generic Switching Center Requirements
IEEE	- Institute of Electrical and Electronics Engineers
IPv4	- Internet Protocol version 4
IPv6	- Internet Protocol version 6
JITC	- Joint Interoperability Test Command
Mbps	- Megabits per second
PMO	- Program Management Office
PWR	- Power over Ethernet
QoS	- Quality of Service
SX	- Short wave laser
T	- BaseT
TE	- Traffic Engineering
UCR	- Unified Capabilities Requirements
VALAN	- Voice Application Local Area Network
vAC	- volts Alternating Current
vDC	- volts Direct Current
VLAN	- Virtual Local Area Network

NOTES:

1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

2 If a system meets the requirements for an ASVALAN, it also meets the lesser requirements for a VALAN.

3 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

4 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria:
   a. Conformant with IPv6 standards profile contained in the DISR.
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

5 The ERS5530-24TFD switch is authorized for use as a distribution switch provided none of the ports are used as access. The ERS5530 switch must be equipped with 48 vDC and 110 vAC power supplies to meet failover requirements. The ten Gigabit per second fiber ports on the ERS5530-24TFD had excessive frame loss, and is not certified by JITC nor authorized for use within the DSN by the PMO.

6 The ERS4500 series and ERS5500 series switches are authorized for use in the access layer as standalone units. The ERS4500 series and ERS5500 series switches are also authorized for use in the access layer in a stacked configuration when the uplink switches are equipped with 48 vDC and 110 vAC power supplies to meet failover requirements.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at https://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the TSSI website at http://jitc.fhu.disa.mil/tssi.